Short Scientific Report

Journal of Plantation Crops, 2013, 41(3): 450-454

Preliminary assessment of eriophyid mite infestation on coconut in Assam

(Manuscript Received: 18-03-13, Revised: 31-08-13, Accepted: 02-09-13)

Keywords: Aceria guerreronis, Assam, coconut, mite infestation

Coconut (*Cocos nucifera*) is a traditional plantation crop of India as well as high value commercial crop covering an area of 1.895 million ha with an annual production of 15,753 million nuts during 2010-11 and productivity of 8,165 nuts per ha (www.indiastat.com). In India most of the cultivated area under coconut palm (90%) lies in the four southern states *i.e*., Kerala, Tamil Nadu, Karnataka and Andhra Pradesh. In Assam coconut is grown mostly in the homestead gardens covering 26 districts in an area about 18,800 ha with productivity of 8,053 nuts ha^{-1} (2010-11).

Although a great number of different insects and mites have been observed feeding on the coconut palm, the widespread outbreak of the eriophyid mite, *Aceria guerreronis* Keifer (Sathiamma *et al.*, 1998) belonging to family Eriophyidae is unique and has shaken the copra industry in India. It is one of the most intractable and major arthropod pests of coconut palm. The coconut mite was described by the eminent acarologist, Hartford Keifer, in 1965 from specimens collected in Guerrero, Mexico. In India, the outbreak of the pest was initially observed in Ernakulam district of Kerala during 1998. Mohanasundaram *et al.* (1999) later fixed its identity as *Aceria guerreronis* Keifer. A survey was conducted by Haq in 1999 to study the distribution of the pest in peninsular India, Sri Lanka and the Lakshadweep islands. Nair and Koshy (2000) reported the extent of damaged palm in Kerala as 20 to 60 per cent. Seguni (2002) observed that mite can cause premature nut fall as high as 10-100 per cent.

In recent years, the pest is seen to be spreading to non-traditional areas like West Bengal, Orissa, Assam, *etc*. In few localities of Assam, eriophyid mite infestation in coconut has been suspected based on the symptoms described in earlier studies. The typical symptoms of eriophyid mite injury are, triangular or elongated white streaks below the perianth. At the separation of floral bracts, mass of *A. guerreronis* develop on the perianth causing physical damage as brown blemishes or patches extending towards the free parts of the nut. As the affected nuts grow, the injuries form warting and longitudinal fissures on the nut surface. The husks develop cracks, cuts and gummosis. Severe infestation results in shedding of buttons and malformation of nuts as a result of retarded growth. Because of their rapid proliferation and easy dispersal through wind, they spread to the neighbouring areas at a faster rate causing heavy loss to the coconut crop. Mite population continues to survive throughout the year in mild to severe form due to availability of host (nuts) in all the seasons.

Considering the importance of coconut as a plantation crop in the state and the potential of this pest to cause extensive damage, the present study was undertaken to gain a preliminary report through survey on prevalence and extent of damage of eriophyid mite in coconut.

A diagnostic survey was carried out in five main coconut growing districts of Assam; Nagaon and Morigaon representing Central Brahmaputra Valley Zone, Kamrup and Goalpara representing Lower Brahmaputra Valley Zone, and Udalguri district representing North Bank Plain Zone. Assam is divided into six different zones depending upon the topography. Maximum coconut grows in the above mentioned three zones. These zones are

located between 25°45' to 26°76' N latitude and 90°07' to 92°33' E longitude. The survey was undertaken during the month of July-August, corresponding to onset of short dry season and end of long rainy season. In almost all surveyed gardens, minimal management followed and fruits were harvested at intervals of 3-4 months. In each district, important villages were selected randomly counting of five farmers. In each garden five matured bunches from randomly selected ten coconut palms were observed to record the damage and other parameters. Parameters like incidence of eriophyid mite, intensity of eriophyid mite, bunch index and mite population both on nut surface and on perianth were recorded. Incidence of eriophyid mite was calculated as percentage of mite infested palms in an area. Intensity was calculated on basis of percentage of mite infested nuts to total nuts present in an infested palm. Bunch index (infestation index) was recorded on a scale of five grade based on scoring as described by Julia and Mariau, 1979 (Nair *et al.*, 2001**)**. The details of the grading followed were Grade 0- Healthy (nuts without damage), Grade 1-nuts with 1-25 per cent area infested by mite, Grade 2- nuts with significant mite damage of 26-50 per cent area, Grade 3-nuts with severe mite infested area of 51-75 per cent and Grade 4-nuts heavily infested by mite with >75 per cent of surface area. Mite population in the research field was estimated from July, 2011 to June, 2012. Microscopic observations for mite population were recorded in 2-3 months old buttons. Two infested buttons from 3rd or 4th bunch of coconut palms from five randomly selected palms were collected for the purpose. Mite population was counted in 3 inner tepals (perianth) and 3 nut surfaces under stereo microscope in 4 mm^2 nut area. All statistical analysis was done following randomized block design using methods as described by Panse and Sukhatme (1995).

(A) Morigaon district

Incidence of *A. guerreronis* damage ranged between 10 and 50 per cent (Table 1) among the eight villages surveyed in Morigaon district. Baropujia has the least incidence of mite and Burapukhuripar and Telahi recorded maximum mite incidence (50%). Intensity of *A. guerreronis* in different villages of Morigaon varied from 53 to 86 per cent with Dolbari village recording highest intensity of mite. Significantly less intensity of mite was recorded in Telahi village showing sporadic attack of mite. Other villages have comparatively more mite intensity. Grading given against the attack of mite showed that except Burapukhuripar, moderate level of infestation was observed in all other villages. There is no such difference in the mite population both on nut surface and on perianth among the villages of Morigaon district.

Table 1. Eriophyid mite infested parameters for the Morigaon district

Village	Incidence (%)	Intensity (%)	Bunch Index	Mite population (no. per 4 mm^2)	
				Nut surface	Perianth
Jorabari	38.0	84.80	1.10	18.24	30.9
	(37.82)	(68.20)		(4.10)	(5.26)
Baropujia	10.0	79.24	1.86	38.8	20.94
	(14.20)	(65.79)		(5.98)	(4.29)
Jaluguti	32.0	76.00	1.87	15.4	13.76
	(31.25)	(62.12)		(3.48)	(3.40)
Dolbari	40.0	86.0	1.28	27.17	26.95
	(36.22)	(68.75)		(4.91)	(4.61)
Telahi	50.0	52.77	1.26	17.64	30.82
	(45.00)	(46.63)		(3.89)	(5.02)
Haladhibari	46.0	78.02	1.45	22.45	30.67
	(42.64)	(64.85)		(4.66)	(4.87)
Saraligaon	20.0	76.02	1.36	27.40	17.08
	(23.41)	(63.27)		(5.09)	(3.98)
Burapukhuripar	50.0	82.84	2.38	23.3	14.66
	(45.04)	(62.49)		(4.81)	(3.87)
CD (0.05)	25.81	17.63	----	NS	NS

*Figures in parenthesis are angular transformed value in case of incidence and intensity; square root transformed value in case of mite population

(B) Nagaon district

Incidence of eriophyid mite among different villages of Nagaon district was comparatively low and no significant difference was observed (Table 2). However, the villages surveyed showed high intensity of this pest ranging between 42 and 82 per cent. Raha recorded highest mite intensity whereas Bhakatgaon had less mite infestation in a single bunch. Kakomari recorded the maximum bunch index corresponding to significant level of nut damage. The mite population on the nut surface and on perianth did not show any significant variation among the villages.

(C) Kamrup district

Moderate level of damage was observed in all the villages. The incidence of *A. gurreronis* in

Table 2. Eriophyid mite infested parameters for the Nagaon district

Village	Incidence (%)	Intensity (%)	Bunch Index	Mite population (no. per 4 mm²)	
				Nut surface	Perianth
Raha	20.0	82.05	2.25	28.08	24.32
	(20.95)	(65.80)		(5.16)	(4.71)
Kakomari	20.0	43.31	2.80	8.90	31.39
	(25.55)	(40.44)		(2.94)	(5.35)
Bebejia	20.0	80.82	1.83	19.59	25.16
	(26.27)	(67.55)		(4.28)	(4.73)
Borduwa	12.0	65.0	2.08	16.48	18.54
	(15.81)	(56.60)		(3.87)	(4.04)
Bhumuraguri	20.0	55.29	2.0	15.19	17.48
	(20.95)	(48.43)		(3.71)	(3.99)
Bhakatgaon	16.0	41.76	1.50	14.76	32.62
	(20.15)	(40.00)		(3.81)	(5.52)
Jajori	14.0	66.70	1.28	27.86	27.12
	(19.41)	(57.96)		(5.16)	(5.08)
Gusaibori	12.0	62.1	1.04	17.64	36.66
	(13.53)	(52.17)		(4.02)	(5.90)
Padumonipathar	22.0	78.83	1.0	14.40	14.29
	(27.48)	(63.57)		(3.69)	(3.76)
Hatisung	20.0	76.83	1.22	22.96	18.66
	(21.12)	(64.62)		(4.46)	(4.24)
CD (0.05)	NS	18.09	-----	NS	NS

*Figures in parenthesis are angular transformed value in case of incidence and intensity; square root transformed value in case of mite population

the plantations of Kamrup is rather low with a maximum 12 per cent was observed in villages like Rani, Mjirgaon, Gerua and Dadara. The intensity of damage varied from 48 per cent in Rani to 82 per cent in Hajo.

(D) Goalpara district

Four villages were surveyed for mite incidence in Goalpara district. The mite incidence was very low (2-6%) (Table 4) on the palms. The intensity of mite infestation in nuts was also low with only 6-21 per cent mite intensity was recorded. The bunch index shows the mild level of infestation by the mites in different villages of Goalpara district.

(E) Udalguri district

Among the four villages surveyed under Udalguri district, Bogoribari village recorded maximum (12%) incidence of *A. gurreronis* followed by Barnagaon (Table 5). The bunch index showed more than 25 per cent damage of the nuts by the mite in Angaragaon village of Udalguri district. The intensity of mite infesting coconut fruit in a tree ranged between 10 and 43 per cent.

Table 3. Eriophyid mite infested parameters for the Kamrup district

Village	Incidence (%)	Intensity (%)	Bunch Index	Mite population (no. per 4 mm²)	
				Nut surface	Perianth
Amingaon	10	60.2	1.50	16.79	12.91
	(2.90)	(51.04)		(3.99)	(3.54)
Agiathuri	10	71.0	1.08	16.18	15.38
	(3.32)	(57.53)		(4.02)	(3.90)
Dadara	12	80.0	1.32	20.78	23.66
	(3.31)	(63.79)		(4.33)	(4.80)
Ghagrapar	10	70.5	0.76	17.43	14.93
	(2.63)	(57.37)		(4.14)	(3.83)
Sesa	10	70.4	1.70	19.74	21.61
	(3.11)	(57.21)		(4.42)	(4.51)
Gerua	12	55.15	1.08	23.06	25.15
	(3.10)	(47.98)		(4.44)	(4.76)
Hajo	12	82.0	1.59	20.01	20.35
	(3.15)	(65.50)		(4.45)	(4.38)
Kamarkuchi	10	49.1	1.16	16.57	17.23
	(3.11)	(44.34)		(4.02)	(4.1)
Rani	12	48.16	1.33	27.86	24
	(3.57)	(43.47)		(5.17)	(4.81)
Majirgaon	12	64.29	0.48	20.11	18.58
	(3.31)	(53.71)		(4.34)	(4.26)
CD (0.05)	NS	11.21	-----	NS	NS

*Figures in parenthesis are angular transformed value in case of intensity; square root transformed value in case of incidence and mite population

Table 4. Eriophyid mite infested parameters for the Goalpara district

Village	Incidence (%)	Intensity (%)	Bunch Index	Mite population (no. per 4 mm²)	
				Nut surface	Perianth
Tilapara	2.0	12.13	0.52	6.20	5.36
	(1.46)	(3.39)		(2.43)	(2.04)
Dudhnoi	6.0	15.0	0.9	7.64	9.68
	(2.18)	(3.81)		(2.74)	(3.14)
Rangjuli	4.0	21.12	0.83	7.03	6.53
	(1.72)	(4.56)		(2.59)	(2.64)
Krishnai	2.0	6.11	0.95	9.37	10.68
	(1.46)	(2.44)		(3.04)	(3.4)
CD (0.05)	NS	0.91	-----	NS	NS

*Figures in parenthesis are square root transformed value

(F) Assam state

The average data for five states revealed that Morigaon district has highest incidence (36%) of *A.guerreronis* followed by Nagaon (18%). Morigaon has also experienced highest intensity (Fig. 1) of mite followed by Nagaon and Kamrup. Similarly Nagaon and Morigaon district had maximum per cent of nut damage by the mite. The mite population was observed to be more in Morigaon, Nagaon and Kamrup districts of Assam (Fig. 2). Increased mite

Table 5. Eriophyid mite infested parameters for the Udalguri district

Village	Incidence (%)	Intensity (%)	Bunch Index	Mite population (no. per 4 mm²)	
				Nut surface	Perianth
Bogoribari	12	38.65	1.0	15.72	10.54
	(3.10)	(38.32)		(3.59)	(3.23)
Angaragaon	8	10.14	1.12	19.46	19.18
	(2.86)	(18.44)		(4.18)	(4.14)
Barnagaon	10	43.21	0.22	20.30	17.88
	(2.84)	(41.09)		(4.33)	(3.86)
Sapangaon	6	41.34	0.71	14.82	13.72
	(2.18)	(40.12)		(3.83)	(3.64)
CD (0.05)	NS	4.63	-----	NS	NS

*Figures in parenthesis are angular transformed value in case of intensity; square root transformed value in case of incidence and mite population

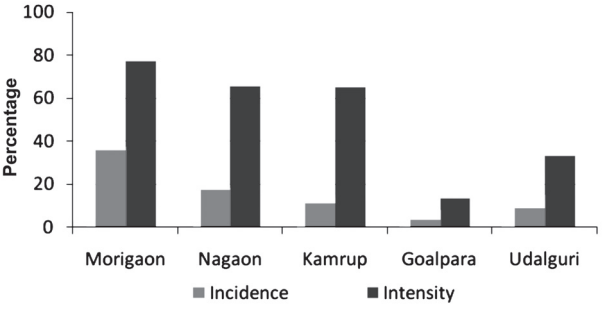

Fig. 1. Per cent incidence and intensity of eriophyid mite in different districts of Assam

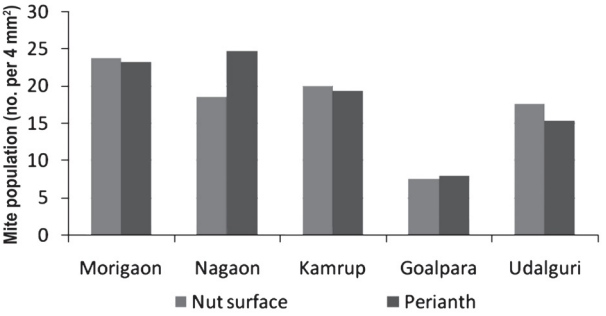

Fig. 2. Mite population at nut surface and perianth in different districts

population in Morigaon and Nagoan might be due to the high population density of coconut and comparatively warm weather in this Central Valley Zone.

(G) Research field

This study was undertaken to draw some inference to the population of mite in different months of the year. Mite population on nut surface did not show any significant variation among different months whereas mite population on perianth show significant variation among the months of a year (Table 6). Due to the tiny size and wormlike body shape, eriophyid species have limited ambulatory dispersal abilities and therefore disperse mostly passively on air currents or through phoresy on winged insects such as honey bees. Nevertheless, in regions with only moderate climatic fluctuations, the distribution patterns of eriophyid populations between infested plant parts are likely to be non-random and heterogeneous over the seasons. The monthly record showed that mite population is invariably high during the dry periods *i.e.*, March-June and September-October. Nair, (2002); Nair *et al.* (2000) also reported the peak incidence of mite population during summer months in India. These periods corresponds to dry period in the state of Assam. Population seems to be less during the winter period (Dec-February) and during the peak monsoon time *i.e.*, during July.

Table 6. Monthwise mite population in CPCRI Kahikuchi

Month	Mite population (no. per 4 mm²)	
	Nut surface	Perianth
July, 2011	10.58	15.44
	(2.86)	(3.44)
August, 2011	36.16	27.81
	(5.81)	(4.75)
September, 2011	70.01	53.98
	(7.44)	(6.97)
October, 2011	98.2	72.66
	(9.23)	(7.72)
November, 2011	55.9	50.76
	(6.83)	(6.46)
December, 2011	21.85	18.74
	(4.17)	(3.95)
January, 2012	23.35	28.66
	(4.66)	(4.56)
February, 2012	25.48	26.71
	(4.66)	(5.03)
March, 2012	65.46	56.48
	(8.16)	(6.52)
April, 2012	99.0	106.38
	(9.94)	(10.01)
May, 2012	50.22	78.14
	(5.59)	(8.55)
June, 2012	68.82	24.86
	(6.14)	(3.79)
Mean	52.08	46.72
	(6.29)	(5.98)
CD (0.05)	NS	3.89

*Figures in parenthesis are square root transformed value

Acknowledgement

The authors are grateful to the Director, CPCRI, Kasaragod for the guidance and facilities provided to carry out the work. Financial support from Central Sector Scheme on Horticulture Mission for North East and Himalayan States is gratefully acknowledged.

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